Estimation Checkpoint

Question (1)

We say that a point estimator is ***unbiased*** if (choose one):

A: its sampling distribution is centered exactly at the parameter it estimates.

B: the standard deviation of its sampling distribution decreases as the sample size increases.

C: its sampling distribution is normal.

D: its value is always equal to the parameter it estimates.

E: Choices (A), (B), and (C) are all true.

Feedback

A : 10

✓ Good job! This is the definition of an unbiased estimator (see the second page about Point Estimation).

B : 0

✗ This is not quite right. The standard deviation of the sampling distribution will decrease as the sample size increases regardless of the bias of the point estimator. Consider the remaining options. (A) is the correct answer.

C : 0

✗ This is not quite right. By the Central Limit Theorem, we know that sampling distributions are mostly normal regardless of the bias of the point estimator. Consider the remaining options. (A) is the correct answer.

D : 0

✗ This is not quite right. The only requirement for a point estimator to be unbiased is that the expected value of the point estimator is the same as the associated population parameter value. Consider the remaining options. (A) is the correct answer.

E : 0

This is not quite right. The standard deviation of the sampling distribution will decrease as the sample size increases regardless of the bias of the point estimator. By the Central Limit Theorem, we know that sampling distributions are mostly normal regardless of the bias of the point estimator. Consider the remaining options. (A) is the correct answer.

The next four questions refer to the following information:

A study was conducted in order to estimate μ, the mean number of weekly hours that U.S. adults use computers at home. Suppose a random sample of 81 U.S. adults gives a mean weekly computer usage time of 8.5 hours and that from prior studies, the population standard deviation is assumed to be σ = 3.6 hours.

Question (2)

Based on this information, what would be the point estimate for μ?

A: 81

B: 8.5

C: 3.6

D: None of the above.

Feedback

A : 0

This is not quite right. 81 represents the size of the sample, not the point estimate for μ, the population mean. Consider the remaining options. (B) is the right answer.

B : 10

Good job! The point estimate for the population mean μ is the sample mean, $\bar{x}$. In this case, to estimate the mean number of weekly hours of home-computer use among the population of U.S. adults, we used the sample mean obtained from the sample, therefore $\bar{x}$ = 8.5.

C : 0

This is not quite right. 3.6 is the assumed population standard deviation, not the point estimate for μ, the population mean. Consider the remaining options. (B) is the right answer.

D : 0

This is not quite right. It may be helpful to review the section on point estimation and then try this question again. (B) is the right answer.

Question (3)

We are 95% confident that the mean number of weekly hours that U.S. adults use computers at home is:

A: between 8.1 and 8.9.

B: between 7.8 and 9.2.

C: between 7.7 and 9.3.

D: between 7.5 and 9.5.

E: between 7.3 and 9.7.

Feedback

A : 0

This is not quite right. It seems that you have found a 68% confidence interval for the mean rather than a 95% confidence interval for the mean. Consider the remaining options. (C) is the right answer.

B : 0

This is not quite right. Remember that the standard deviation you should be using for this calculation is σ n . Consider the remaining options. (C) is the right answer.

C : 10

✓ Good job! The 95% confidence interval for the mean, μ, is x ¯ ± 2 · σ n = 8.5 ± 2 · 3.6 81 = 8.5 ± . 8 = (7.7 , 9.3) . .

D : 0

✗ This is not quite right. Remember that the standard deviation you should be using for this calculation is σ n . Consider the remaining options. (C) is the right answer.

E : 0

✗ This is not quite right. It seems that you have found a 99.7% confidence interval for the mean rather than a 95% confidence interval for the mean. Consider the remaining options. (C) is the right answer.

Question (4)

Which of the following will provide a more informative (i.e., narrower) confidence interval than the one in problem 3?

A: Using a sample of size 400 (instead of 81).

B: Using a sample of size 36 (instead of 81).

C: Using a different sample of size 81.

D: Using a 90% level of confidence (instead of 95%).

E: Using a 99% level of confidence (instead of 95%).

F: Both (A) and (D) are correct.

G: Both (A) and (E) are correct.

Feedback

A : 0

✗ This is not quite right. Although increasing the sample size will provide a narrower confidence interval, there is a better option. Consider the remaining options. (F) is the right answer.

B : 0

This is not quite right. Remember that $\sigma \bar{x} = \sigma n$. As a result, decreasing the sample size will increase the standard deviation of the sampling distribution of the mean. Consider the remaining options. (F) is the right answer.

C : 0

This is not quite right. This may cause the point estimator, $\bar{x}$, to change. However, the width of the confidence interval will stay the same. Consider the remaining options. (F) is the right answer.

D : 0

This is not quite right. Although decreasing the confidence level will result in a narrower confidence interval, there is a better option. Consider the remaining options. (F) is the right answer.

E : 0

This is not quite right. Increasing the confidence level will result in a wider confidence interval. Consider the remaining options. (F) is the right answer.

F : 10

Good job! In general, we can obtain a more informative (narrower) confidence interval in one of two ways: compromising on the level of confidence (in other words, choosing a lower level of confidence), or increasing the sample size (that might be impossible in practice, though).

G : 0

This is not quite right. Increasing the confidence level will result in a wider confidence interval. Consider the remaining options. (F) is the right answer.

Question (5)

How large a sample of U.S. adults is needed in order to estimate μ with a 95% confidence interval of ***length*** 1.2 hours?

A: 6

B: 12

C: 20

D: 36

E: 144

Feedback

A : 0

This is not quite right. Remember that the sample size you should be using is found by using the following equation: length = 2 * margin of error. Consider the remaining options. (E) is the correct answer.

B : 0

This is not quite right. Remember that the sample size you should be using is found by using the following equation: length = 2 * margin of error. Consider the remaining options. (E) is the correct answer.

C : 0

This is not quite right. Remember that the sample size you should be using is found by using the following equation: length = 2 * margin of error. Consider the remaining options. (E) is the correct answer.

D : 0

This is not quite right. Remember that the sample size you should be using is found by using the following equation: length = 2 * margin of error. Consider the remaining options. (E) is the correct answer.

E : 10

Good job! We would like our confidence interval to be a 95% confidence interval (implying that z* = 2) and the confidence interval length should be 1.2, therefore the margin of error (m) = 1.2 / 2 = .6. The sample size we need in order to obtain this is: 144.

These next two questions refer to the following information:

A researcher would like to estimate p, the proportion of U.S. adults who support recognizing civil unions between gay or lesbian couples.

Question (6)

If the researcher would like to be 95% sure that the obtained sample proportion would be within 1.5% of p (the proportion in the entire population of U.S. adults), what sample size should be used?

A: 17,778
B: 4,445
C: 1,112
D: 67
E: 45

Feedback

A : 0

This is not quite right. Remember that in order to estimate p with a 95% confidence interval with a margin of error of m, the sample size must be at least $1/m^2$. (B) is the right answer.

B : 10

Good job! In order to estimate the population proportion, p, with a 95% confidence interval with a margin of error of m, we need a sample size of (at least) $1/m^2$. In this case, the desired m is 1.5% = .015. Thus, the required n is 4,445 (remember, always round up for sample size).

C : 0

This is not quite right. Remember that in order to estimate p with a 95% confidence interval with a margin of error m, the sample size must be at least $1/m^2$. (B) is the right answer.

D : 0

✗ This is not quite right. Remember that in order to estimate p with a 95% confidence interval with a margin of error m, the sample size must be at least $1/m^2$. (B) is the right answer.

E : 0

✗ This is not quite right. Remember that in order to estimate p with a 95% confidence interval with a margin of error m, the sample size must be at least $1/m^2$. (B) is the right answer.

Question (7)

Due to a limited budget, the researcher obtained opinions from a random sample of only 2,222 U.S. adults. With this sample size, the researcher can be 95% confident that the obtained sample proportion will differ from the true proportion (p) by no more than (answers are rounded):

A: .04%

B: .75%

C: 2.1%

D: 3%

E: There is no way to figure this out without knowing the actual sample proportion that was obtained.

Feedback

A : 0

✗ This is not quite right. Remember that for a sample size of n, the sample proportion p ˆ will differ from the "true" population proportion by no more than 1/sqrt n. Consider the remaining options. (C) is the right answer.

B : 0

✗ This is not quite right. Remember that for a sample size of n, the sample proportion p ˆ will differ from the "true" population proportion by no more than 1/sqrt n. Consider the remaining options. (C) is the right answer.

C : 10

Good job! Remember that for a sample size of n, the sample proportion p ˆ will differ from the "true" population proportion by no more than 1/sqrt n. In this case, this is about 2.1%.

D : 0

This is not quite right. Remember that for a sample size of n, the sample proportion p ˆ will differ from the "true" population proportion by no more than 1/sqrt n. Consider the remaining options. (C) is the right answer.

E : 0

This is not quite right. It may be helpful to look over this section again. (C) is the right answer.